APPENDIX A

SAMPLE PROPOSED PLAN

Superfund Program Proposed Plan

EIO Industrial Site

Region 4

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternative for cleaning up the contaminated soil and ground water at the EIO Industrial Site and provides the rationale for this preference. In addition, this Plan includes summaries of other cleanup alternatives evaluated for use at this site. This document is issued by the U.S. Environmental Protection Agency (EPA), the lead agency for site activities, and the Tennessee Department of Environment and Conservation (TDEC), the support agency. EPA, in consultation with the TDEC, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. EPA, in consultation with the TDEC, may modify the Preferred Alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on <u>all</u> the alternatives presented in this Proposed Plan.

EPA is issuing this Proposed Plan as part of its public participation responsibilities under Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Proposed Plan summarizes information that can be found in greater detail in the RI/FS report and other documents contained in the Administrative Record file for this site. EPA and the State

Dates to remember:
MARK YOUR CALENDAR

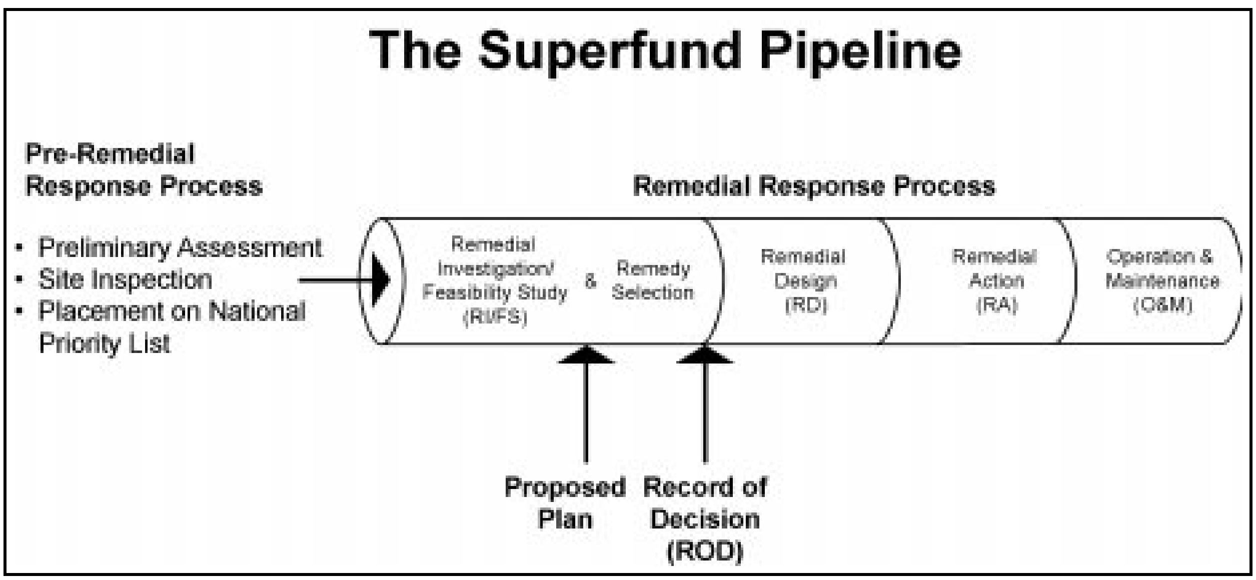
PUBLIC COMMENT PERIOD:
March 1 - March 30, 1999
U.S. EPA will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING:
March 13, 1999
U.S. EPA will hold a public meeting to explain the Proposed Plan and all of the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held at Nameless Community Hall, 237 Appleton Street, Nameless, TN at 7:30 p.m.

For more information, see the Administrative Record at the following locations:

Public Library
619 South 20th Street
Nameless, TN 00000
(101) 999-1099
Hours: Mon-Sat,
9 a.m. to 9 p.m.

U.S. EPA Records Center
Region 4
61 Forsyth Street, S.W.
Atlanta, GA 30303-3104
(555)-555-5555
Hours: Mon-Fri,
8:30 a.m. to 5:00 p.m.

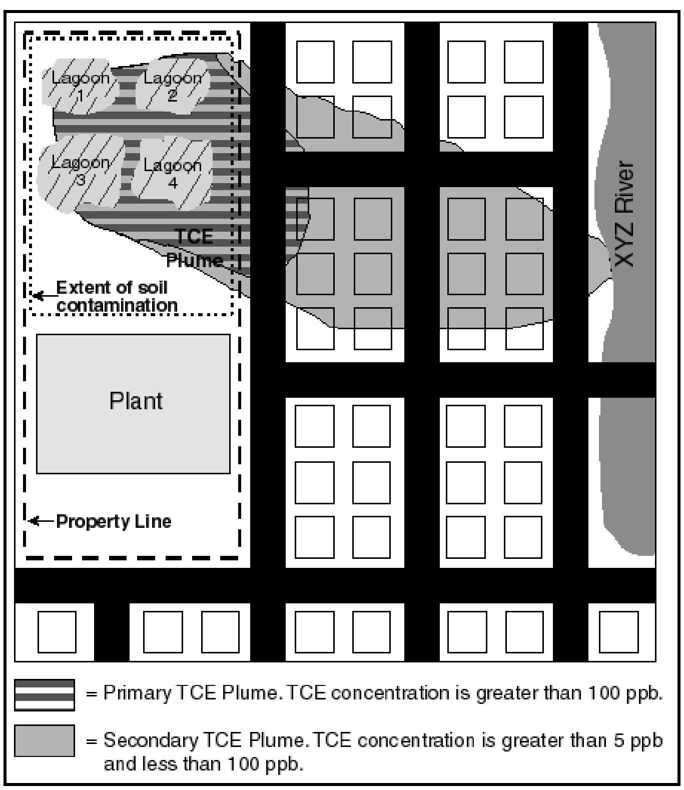


encourage the public to review these documents to gain a more comprehensive understanding of the site and Superfund activities that have been conducted at the site.

SITE HISTORY

Beginning in the early 1980s, the EIO Industrial Company disposed of liquid industrial wastes at its plant located at 81 North Delaware Avenue in Nameless, Tennessee. The wastes were disposed of in four unlined lagoons on the ten-acre site until site operations ceased in 1990. As a result of disposal activities, contaminants seeped from the lagoons into site soil. Although the EIO Industrial Company emptied the lagoons in 1991, the soil remained contaminated. In addition, ground water is contaminated at and around the site. The ground water served as a drinking water source for area residents until EPA provided an alternate water supply in 1996.

The site was placed on the Superfund National Priorities List (NPL) in 1994. On January 11, 1995, a consent decree was lodged among EPA, TDEC, and the EIO Industrial Company outlining the terms by which the cleanup would be conducted. Under the terms of the consent decree, which was approved by an Administrative Judge following a public comment period, the EIO Industrial Company will implement, and incur all costs associated with, the agreed upon response action.



SITE CHARACTERISTICS

In 1996 and 1997, the EIO Industrial Company conducted a Remedial Investigation/Feasibility Study (RI/FS) under EPA's oversight. The RI/FS identified the types, quantities, and locations of contaminants and developed ways to address the contamination problems. The RI indicated that:

- Within the former lagoon area, on-site surface and subsurface soils are contaminated with benzo(a)pyrene (B[a]P), 4,4'-DDT, and dieldrin. Contamination extends to a depth of three feet over a 225' x 300' area.
- A plume of ground water contaminated with trichloroethylene (TCE) extends from the site to the XYZ River, which is a half-mile away. The plume of

WHAT ARE THE "CONTAMINANTS OF CONCERN"?

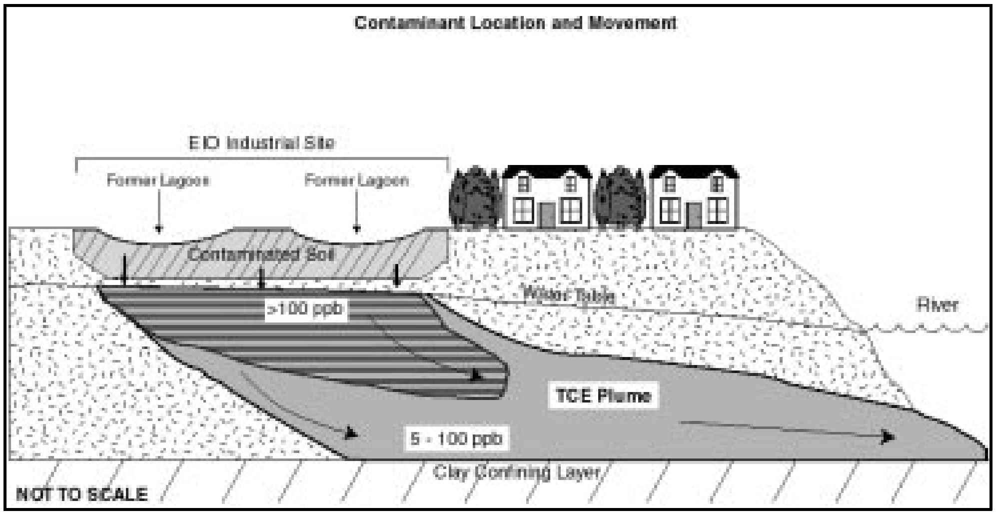
EPA and the TDEC have identified four contaminants that pose the greatest potential risk to human health at this site.

Benzo(a)pyrene (B(a)P): Benzo(a)pyrene, detected onsite at concentrations ranging from 100 to 430 ppm, is a polycyclic aromatic hydrocarbon (PAH) that is formed when gasoline, garbage, or any animal or plant material is burned. It is found in cigarette smoke, soot, creosote, and the coal tar pitch that industry uses to join electrical parts together. B(a)P is a probable human carcinogen. According to information provided by the Agency for Toxic Substances and Disease Registry (ATSDR), B(a)P has been found to cause cancer in laboratory animals when applied to their skin. It has also been shown to be harmful to mice fetuses, causing birth defects and lower-than-normal body weight in newborns. B(a)P is not very mobile and binds readily to soils.

4,4'-DDT: DDT, detected onsite at concentrations ranging from 20 to 350 ppm, is an organochlorine compound widely used after WWII as an agricultural pesticide and malaria control agent. The United States banned the use of DDT in 1972 because of its adverse environmental and health effects. DDT is a probable human carcinogen. Short-term exposure to DDT primarily affects the central nervous system; direct contact may cause rashes or irritation of the eyes, nose and throat. Long-term exposure at low doses causes some changes in the level of liver enzymes in humans. DDT can persist for a long time in the environment, bound to soils.

Dieldrin: Dieldrin, detected onsite at concentrations ranging from 15 to 60 ppm, is an organochlorine compound widely used from the 1950s to 1970s as an insecticide in agriculture, for subsurface termite treatment, and for control of disease vectors such as mosquitos. Most uses of dieldrin (termite control was an exception) were banned in 1974 because of its adverse environmental and health effects. In 1987 EPA banned all uses of dieldrin. Dieldrin is a probable human carcinogen. Short-term exposure to dieldrin can cause headaches, dizziness, loss of consciousness, nausea, and loss of appetite. Dieldrin can persist for a long time in the environment, bound to soils.

Trichloroethylene (TCE): TCE, detected in ground water at concentrations ranging from 0.055 to 12 ppm, is a halogenated organic compound historically used as a solvent and degreaser in many industries. Exposure to this compound has been associated with deleterious health effects in humans, including anemia, skin rashes, diabetes, liver conditions, and urinary tract disorders. Based on laboratory studies, TCE is considered a probable human carcinogen.



contaminants is confined to the surficial aquifer, and has not penetrated a clay confining layer that occurs approximately 45' below ground surface. TCE was not detected in any of the soil samples collected from the site.

- In the immediate vicinity of the former lagoons, concentrations of ground water contaminants exceed 100 parts per billion (ppb) (the "primary" plume). The remainder of the plume (the "secondary" plume) is delineated as the area in which TCE concentrations exceed 5 ppb, the Maximum Contaminant Level (MCL) for TCE in drinking water.

The contaminated soils in the area of the lagoons are considered to be "principal threat wastes" because the chemicals of concern are found at concentrations that pose a significant risk. The excess carcinogenic risk to an individual posed by these materials is upwards of one in one hundred (1×10^{-2}). In other words, if the contaminated soil at the EIO Site is not remediated, as many as one out of every 100 individuals exposed to the soil could develop cancer as a result of that exposure. Although contaminated ground water also poses a risk, it is not considered a "principal threat" as defined by EPA guidance.

WHAT IS A "PRINCIPAL THREAT"?

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to ground water, surface water or air, or acts as a source for direct exposure. Contaminated ground water generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in ground water may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

SCOPE AND ROLE OF THE ACTION

This action, referred to as Operable Unit 2 (OU2), will be the final action for the site. A 1996 ROD for Operable Unit 1 (OU1) provided for an alternate water supply by connecting 50 homes to the public water distribution system. The Remedial Action Objectives for OU2 are to prevent current and future exposure to contaminated media through a combination of treatment and containment of soil and ground water at the EIO Site. Through the use of treatment technologies, this response will permanently reduce the toxicity, mobility, and volume of those source materials that constitute the principal threat wastes at the site.

SUMMARY OF SITE RISKS

As part of the RI/FS, EPA conducted a baseline risk assessment to determine the current and future effects of contaminants on human health and the environment. According to the zoning board of Nameless, TN, the area adjacent to the site is zoned for residential usage. Therefore, this is the reasonably anticipated future land use for the site itself. In addition, the potential future use of ground water will be as a drinking water source for the community once safe cleanup levels have been achieved. Hence, the baseline risk assessment focused on health effects for both children and adults, in a residential setting, that could result from current and future direct contact with: (1) contaminated soil (*e.g.*, children ingesting soil while playing in the area), and (2) contaminated ground water (*e.g.*, through ingestion and inhalation of volatile contaminants). It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Human Health Risks

EPA's statistical analysis of soil sampling data indicates that probable exposure concentrations of B[a]P, 4,4'-DDT, and dieldrin in soil are 300 parts per million (ppm), 350 ppm, and 40 ppm, respectively. These concentrations are associated with

WHAT IS RISK AND HOW IS IT CALCULATED?

A Superfund human health risk assessment estimates the "baseline risk." This is an estimate of the likelihood of health problems occurring if no cleanup action were taken at a site. To estimate the baseline risk at a Superfund site, EPA undertakes a four-step process:

Step 1: Analyze Contamination
Step 2: Estimate Exposure
Step 3: Assess Potential Health Dangers
Step 4: Characterize Site Risk

In Step 1, EPA looks at the concentrations of contaminants found at a site as well as past scientific studies on the effects these contaminants have had on people (or animals, when human studies are unavailable). Comparisons between site-specific concentrations and concentrations reported in past studies helps EPA to determine which contaminants are most likely to pose the greatest threat to human health.

In Step 2, EPA considers the different ways that people might be exposed to the contaminants identified in Step 1, the concentrations that people might be exposed to, and the potential frequency and duration of exposure. Using this information, EPA calculates a "reasonable maximum exposure" (RME) scenario, which portrays the highest level of human exposure that could reasonably be expected to occur.

In Step 3, EPA uses the information from Step 2 combined with information on the toxicity of each chemical to assess potential health risks. EPA considers two types of risk: cancer risk and non-cancer risk. The likelihood of any kind of cancer resulting from a Superfund site is generally expressed as an upper bound probability; for example, a "1 in 10,000 chance." In other words, for every 10,000 people that could be exposed, one extra cancer *may* occur as a result of exposure to site contaminants. An extra cancer case means that one more person could get cancer than would normally be expected to from all other causes. For non-cancer health effects, EPA calculates a "hazard index." The key concept here is that a "threshold level" (measured usually as a hazard index of less than 1) exists below which non-cancer health effects are no longer predicted.

In Step 4, EPA determines whether site risks are great enough to cause health problems for people at or near the Superfund site. The results of the three previous steps are combined, evaluated and summarized. EPA adds up the potential risks from the individual

excess lifetime cancer risk levels due to ingestion of contaminated soil of 1.2×10^{-2}, 6.5×10^{-4}, and 3.5×10^{-3}, respectively for current residents. Hazard quotients of 3.9 for 4,4'-DDT and 4.4 for dieldrin also are associated with these exposure concentrations.

Similarly, EPA's statistical analysis of ground water sampling data found that the average exposure concentration of TCE in the ground water was 8,400 ppb, which is in excess of the Safe Drinking Water Act MCL of 5 ppb. In addition, this concentration is associated with an excess lifetime cancer risk of 2.5×10^{-3} for current residents. Dieldrin, 4,4'-DDT and B[a]P were not found in ground water at concentrations above their detection limits.

These risks and hazard levels indicate that there is significant potential risk to children and adults from direct exposure to contaminated soil and ground water. These risk estimates are based on current reasonable maximum exposure scenarios and were developed by taking into account various conservative assumptions about the frequency and duration of an individual's exposure to the soil and ground water, as well as the toxicity of B[a]P, 4,4'-DDT, dieldrin, and TCE.

Ecological Risks

A screening ecological risk assessment indicated that the potential for significant ecological impacts to occur was small. Based upon the relatively small size of the contaminated source areas (*i.e.*, the soil that had been under the lagoons) in comparison to the home ranges of the target ecological receptor habitats and the lack of any current natural habitat in these areas, there was little potential for significant exposure of wildlife to the contaminants. The concentrations of TCE found in the XYZ River is below the freshwater screening level of 350 µg/l (ppb).

REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) for the site are to:

- Restore the aquifer to drinking water standards within a reasonable time frame.
- Minimize future migration of ground-water contamination.
- Reduce or eliminate further contamination of ground water.
- Reduce or eliminate the direct contact threat associated with contaminated soil.
- Minimize or eliminate contaminant migration to the ground water and surface waters to levels that ensure the beneficial reuse of these resources.

This proposed action will reduce the excess cancer risk associated with exposure to contaminated soil to one in one million. This will be achieved by reducing the concentrations of the soil contaminants to the following target levels:

Benzo(a)pyrene	0.026 ppm
DDT	0.012 ppm
Dieldrin	0.54 ppm

Because there are no Federal or State cleanup standards for soil contamination, EPA established these targets, or Preliminary Remediation Goals (PRGs), based on the baseline risk assessment. Targets were selected that would both reduce the risk associated with exposure to soil contaminants to an acceptable level, and ensure minimal migration of contaminants into the ground water. The Preliminary Remediation Goal for TCE in ground water is 0.005 ppm, which is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.

SUMMARY OF REMEDIAL ALTERNATIVES

Remedial alternatives for the EIO Site are presented below. The alternatives are numbered to correspond with the numbers in the RI/FS Report.

Common Elements. Many of these alternatives include common components. The soil contains hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) and is therefore subject to the RCRA land disposal restrictions (LDRs) if the waste is excavated and treated or removed from the area of contamination. All remedies involving such activities will comply with the LDR (63 FR 28555; May 26, 1998) and will meet 90% removal efficiency or ten times the universal treatment standard for that contaminant in the material prior to land disposal in a RCRA-compliant landfill.

The ground water does not contain RCRA hazardous waste and therefore the LDR standards are not applicable, and are also not relevant or appropriate requirements.

Several of the remedies require institutional controls (e.g., deed restrictions such as an easement or covenant) to limit the use of portions of the property or to ensure that the water is not used for drinking water purposes. These resource use restrictions are discussed in each alternative as appropriate. The type of restriction and enforceability will need to be determined for the selected remedy in the ROD. Consistent with expectations set out in the Superfund regulations, none of the remedies rely exclusively on institutional controls to achieve protectiveness. Monitoring to ensure the effectiveness of the remedy, including deed restrictions, are a component of each alternative except the “no-action” alternative.

Each ground water alternative (except the “no action” and the monitored natural attenuation alternatives) requires extraction of ground water prior to treatment. Additionally, each treatment alternative is evaluated under two ground water disposal options: (1) discharge to XYZ River, and (2) reinjection into the aquifer. All soil and ground water alternatives, except the “no action” alternatives, are expected to attain the Remedial Action Objectives.

NO ACTION ALTERNATIVES

Alternative S1/G1: NO ACTION

Estimated Capital Cost: $0
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $0

SUMMARY OF REMEDIAL ALTERNATIVES
EIO INDUSTRIAL SITE

Medium	RI/FS Designation	Description
SOIL	S1	No action
	S2	Cap waste in place; institutional controls; monitoring
	S3	Excavate wastes; on-site thermal desorption; on-site disposal of residual wastes with vegetative cover
	S5	Excavate wastes; off-site thermal destruction; off-site disposal of residual wastes
GROUND WATER	G1	No action
	G2	Pump and treat the entire plume; discharge to XYZ River
	G3	Pump and treat the entire plume; vicinity reinjection
	G5	Pump and treat the "primary" plume; discharge to XYZ River; natural attenuation of "secondary" plume
	G7	Pump and treat the "primary" plume; vicinity reinjection; natural attenuation of "secondary" plume
	G8	Monitored natural attenuation of the entire plume

Estimated Construction Timeframe: None

Regulations governing the Superfund program generally require that the "no action" alternative be evaluated generally to establish a baseline for comparison. Under this alternative, EPA would take no action at the site to prevent exposure to the soil and ground water contamination.

SOIL ALTERNATIVES

Alternative S2: CAPPING WASTE IN PLACE, INSTITUTIONAL CONTROLS, MONITORING.

Estimated Capital Cost: $3,500,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $3,500,000
Estimated Construction Timeframe: 9 months
Estimated Time to Achieve RAOs: 9 months

Approximately 7,500 cubic yards of soil would be capped in place with a RCRA hazardous waste compliance cap. Institutional controls would be put in place to prevent the use of the area for any purposes other than waste management. This is necessary to ensure that the cap is not impaired due to other activities. Since direct contact exposure will not pose a risk with a cap, restricting access to the capped area will not be required. However, signs will be posted around the perimeter of the area that provides notice that hazardous waste are contained in the area. The area would be monitored in perpetuity to verify that the cap retains integrity, is not leaking, and that the institutional controls remained effective.

Alternative S3: EXCAVATION, ON-SITE THERMAL DESORPTION, AND ON-SITE DISPOSAL OF RESIDUALS.

Estimated Capital Cost: $6,230,000
Estimated Annual O&M Cost: $0
Estimated Present Worth Cost: $6,230,000
Estimated Construction Timeframe: 3 months
Estimated Time to Achieve RAOs: 24 months

Approximately 7,500 cubic yards of soil would be excavated and would be treated by on-site thermal desorption. The treated soil will be returned to the excavated area and capped with a vegetative cover if the material meets the final cleanup levels. If the technology does not achieve the remedial cleanup level standards for the waste left in place, the waste would be disposed of off-site at a RCRA hazardous waste Subtitle C facility. (Such material would meet the LDR standards prior to disposal.) It is expected that thermal treatment will achieve the health-based standards. The contaminants collected from the thermal desorption process will be sent off-site to a RCRA Subtitle C hazardous waste facility for treatment and disposal in accordance with the RCRA LDR standards.

Since this alternative will achieve Preliminary Remediation Goals or better that are protective for residential land use, and which are protective for all other uses, institutional controls and monitoring will not be needed for this alternative.

Alternative S5: EXCAVATION, OFF-SITE THERMAL DESTRUCTION, AND OFF-SITE DISPOSAL OF RESIDUALS

Estimated Capital Cost: $6,731,317
Estimated Annual O&M Cost: $ 0
Estimated Present Worth Cost: $6,731,317
Estimated Construction Timeframe: 0
Estimated Time to Achieve RAOs: 12 months

This alternative is the same as S3 except that the waste is transported off-site to a RCRA hazardous waste Subtitle C facility for the treatment and disposal of the soil. For the purposes of developing a cost estimate, the assumed treatment technology was an off-site incinerator, but any technology that can achieve the LDR treatment standards for contaminated soil could be used during the actual implementation of the remedy.

GROUND WATER ALTERNATIVES

Alternative G2: PUMP AND TREAT THE ENTIRE PLUME WITH DISCHARGE TO THE XYZ RIVER

Estimated Capital Cost: $ 3,650,000
Estimated Annual O & M Cost: $ 124,000
Estimated Present Worth Cost: $ 4,779,000
Estimated Construction Timeframe: 15 to 18 months
Estimated Time to Achieve RAOs: 15 years

Ground water extraction wells would be placed at locations selected to capture the entire area of the contaminated ground-water plume. Once extracted, the contaminated ground water would be treated on site by using a combination of air-stripping and/or carbon adsorption and would then be discharged to the XYZ River. The ground water would be restored to drinking water quality through treatment to meet the final cleanup levels throughout the entire plume. Restrictions on the installation of new drinking water wells will be implemented by the town zoning authority. Existing wells will be sealed to prevent exposure to contaminated ground water.

During the remedial design phase, EPA will determine the most cost-effective technology for treating the extracted ground water. These technologies will include either carbon adsorption or air stripping alone or in combination to meet the National Pollutant Discharge Elimination System (NPDES) requirements and State and/or local air quality standards. Any carbon units used for on-site treatment will be regenerated off-site. Used carbon units will be disposed of in accordance with RCRA requirements.

Alternative G3: PUMP AND TREAT THE ENTIRE PLUME WITH VICINITY REINJECTION

Estimated Capital Cost: $ 10,752,000
Estimated Annual O& M Cost: $ 167,000
Estimated Present Worth Cost: $ 12,078,000
Estimated Construction Timeframe: 18 to 24 months
Estimated Time to Achieve RAOs: 12 years

The components and requirements of this alternative are the same as those described in Alternative G2, with the exception that the treated ground water would be reinjected into the aquifer rather than discharged to the XYZ River. Reinjection wells would be located at selected points to enhance flushing within the contaminant plume.

Alternative G5: PUMP AND TREAT THE PRIMARY PLUME WITH DISCHARGE TO THE XYZ RIVER AND MONITORED NATURAL ATTENUATION OF THE SECONDARY PLUME.

Estimated Capital Cost: $ 2,850,000
Estimated Annual O& M Cost: $ 84,000
Estimated Present Worth Cost: $ 3,695,000
Estimated Construction Timeframe: 12 to 15 months
Estimated Time to Achieve RAOs: 18 years

In this alternative, ground-water extraction wells would be placed at locations selected to capture the primary plume and the secondary plume would be allowed to remediate through natural physical, chemical and biological processes (also known as natural attenuation). Isolation and cleanup of the primary plume would prevent further contamination to the secondary plume and expedite attainment of final cleanup levels in the secondary plume through natural attenuation. Ground water extracted from the primary plume would be treated in the same manner as described in Alternative G2. The ground water would be restored to drinking water use through treatment and natural attenuation to meet the final cleanup levels throughout the entire plume.

Alternative G7: PUMP AND TREAT THE PRIMARY PLUME WITH VICINITY REINJECTION AND MONITORED NATURAL ATTENUATION OF THE SECONDARY PLUME.

Estimated Capital Cost: $ 8,250,000
Estimated Annual O& M Cost: $ 107,000
Estimated Present Worth Cost: $ 9,225,000
Estimated Construction Timeframe: 15 - 18 months
Estimated Time to Achieve RAOs: 15 years

The components and requirements of this alternative are the same as those described in Alternative G5, with the exception that the treated ground water would be reinjected into the aquifer rather than discharged to the XYZ River. Reinjection wells would be located at selected points to enhance flushing of contaminants within the contaminant plume and facilitate natural attenuation processes.

Alternative G8: MONITORED NATURAL ATTENUATION OF ENTIRE PLUME

Estimated Capital Cost: $ 15,000
Estimated Annual O& M Cost: $ 34,000
Estimated Present Worth Cost: $ 501,000
Estimated Construction Timeframe: 3 months
Estimated Time to Achieve RAOs: 220 years

This alternative would utilize natural physical, chemical and biological processes (i.e., natural attenuation) to restore ground water to drinking water use. Final cleanup levels would be met throughout the entire plume within an estimated timeframe of 220 years.

EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.
Compliance with ARARs evaluates whether the alternative meets Federal and State environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.
Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.
Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, residents, and the environment during implementation.
Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.
State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
Community Acceptance considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

EVALUATION OF ALTERNATIVES

Nine criteria are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other options under consideration. The nine evaluation criteria are discussed below. The “Detailed Analysis of Alternatives” can be found in the FS.

1. Overall Protection of Human Health and the Environment

All of the alternatives except the “no action” alternative would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, and/or institutional controls. Chemicals of concern are treated to risk-based levels by Alternative S3 (on-site thermal desorption) and Alternative S5 (off-site thermal destruction). Alternative S2 would provide protection by preventing direct contact exposure to contaminated soils and prevent leakage of these contaminated source materials to the ground water by capping the area; however, long-term maintenance and monitoring would be required to ensure that the cap remained protective.

With the exception of Alternative G8 (monitored natural attentuation), all ground water alternatives would eliminate human and environmental risks from direct contact with contaminated ground water through treatment. Although Alternative G8 does not prevent migration of contaminants to the XYZ River, surface water quality standards are not being exceeded and therefore is still considered protective. Experience has shown that in some cases reinjecting ground water (Alternatives G3 and G7) may cause some horizontal or downward migration of contaminants, increasing the potential for exposure to contaminated ground water. At this site, such contaminant migration is not likely to occur due to the presence of a confining clay layer and the site’s proximity to the river. All alternatives include institutional controls as an added means of protecting human health.

Because the “no action” alternatives (S1 and G1) are not protective of human health and the environment, they were eliminated from consideration under the remaining eight criteria.

2. Compliance with ARARs

All soil and ground water alternatives would meet their respective ARARs from Federal and State laws.

3. Long-term Effectiveness and Permanence

Alternative S3 (on-site thermal desorption) and Alternative S5 (off-site thermal destruction) would reduce the inherent hazards posed by the contaminants at the site to health-based levels and further controls would not be necessary to ensure the long-term effectiveness and permanence. Alternative S2 (capping) would prevent the direct contact exposure and contaminant migration, however, monitoring would be necessary to ensure the long-term effectiveness and permanence of this alternative.

All ground water alternatives would be effective in the long term by reducing contaminant concentrations in ground water. The adequacy and reliability of the pump and treatment technologies have been well proven for the chemicals of concern. However, experience has shown that reinjection systems (G3, G7) have extensive maintenance problems and as such may not be considered reliable. Natural attenuation has some uncertainty associated with the remediation methods and the time required to reach the final cleanup levels (G5, G7, G8).

4. **Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment**

Both Alternative S3 (on-site thermal desorption, the preferred alternative) and Alternative S5 (off-site, thermal destruction) would remove or destroy the contaminants from soil, and may in fact get the soil down to the Preliminary Remediation Goals without further need for subsequent containment. Alternative S2 (capping) will not achieve reduction of toxicity, mobility or volume through treatment.

All ground water alternatives, except for G8, use treatment to reduce toxicity, mobility and volume of contaminants. Alternative G8 uses natural processes to achieve the same goals. For all other alternatives, carbon units containing treatment residuals would be thermally destroyed or recycled, and managed in accordance with RCRA.

5. **Short-term Effectiveness**

Both Alternative S3 (on-site thermal desorption) and Alternative S5 (off-site thermal destruction) involve excavation of contaminated soils and thus present a potential for short-term exposure. Alternative S5 presents a higher short-term risk than Alternative S3 because of the potential for exposure to contaminated soils by trucking the 7,500 cubic yards of material to an off-site facility.

The contaminants are not volatile so the risk of release is principally limited to wind blown soil transport or surface water run off. Control of dust and run-off will limit the amount of materials that may migrate to a potential receptor. Alternative S3 and Alternative S5 also present a potential risk for short-term exposure to releases of contaminants or products of combustion as a result of the treatment technology. In both cases the treatment unit will be required to meet the RCRA emissions standards (i.e., RCRA Subpart X would apply to thermal desorbption units and Subpart O would apply to incineration units). Alternative S2 (capping) does not present a short-term threat except to the extent that area presents direct contact or migration potential during the time it takes to fully implement the remedy. Construction of Alternative S3 (on-site thermal desorption) could be completed in 3 months, with achievement of remedial action objectives within 2 years. Alternative S5 (off-site thermal destruction) will not require construction, and would thus enable cleanup objectives to be achieved in less than 2 years. Completion of Alternative S2 (capping) would take 9 months to construct.

Precautions will be taken during construction of the extraction wells under Alternatives G2, G3, G5 and G7 to eliminate any risk to the public from excavation. Because ground water remediation will occur after completion of soil remediation, air emissions during well-drilling should not constitute a threat. Short-term risk to workers associated with normal construction hazards and potential contact with contaminated water will be eliminated through appropriate controls and adherence to proper health and safety protocols. G2, G3, G5, and G7 will take approximately the same amount of time to achieve final cleanup levels. However, Alternative G3 would require a longer construction period due to the installation of reinjection wells or infiltration basins, and piping systems to transport the treated ground water to the wells or basins. Under Alternative G2, only a small amount of time is needed to construct the pipeline to the XYZ River. Alternative G8 has no risks associated with implementation and requires little or no implementation time.

6. **Implementability**

All soil technologies and remedies are readily available and generally proven.

All ground water alternatives are equally implementable without construction difficulties. Ground water “pump and treat” is well-proven and fully capable of removing the contamination. There is a potential for operation and maintenance problems associated with reinjecting the large volume of water into the aquifer, under Alternatives G3 and G7. All alternatives have few associated administrative difficulties.

7. **Cost**

The estimated present worth cost of Alternative S3 is less than that of Alternatives S5. The estimated present worth cost of Alternative G5 is less than G2, G3, and G7. Even though Alternative G8 is the least costly of the remedial alternatives, the time frame required to achieve final cleanup levels is excessive.

8. **State/Support Agency Acceptance**

The State of Tennessee supports the Preferred Alternative without comment.

9. **Community Acceptance**

Community acceptance of the preferred alternative will be evaluated after the public comment period ends and will be described in the ROD for the site.

SUMMARY OF THE PREFERRED ALTERNATIVE

The Preferred Alternative for cleaning up the EIO Site is a combination of Soil Alternative S3 (Excavation, On-Site Thermal Desorption, and On-Site Disposal of Residuals) and Ground-Water Alternative G5 (Pump and Treatment of the Primary Plume with Discharge to the XYZ River and Monitored Natural Attenuation of the Secondary Plume).

The preferred soil alternative was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through treatment, and is expected to allow the property to be used for the reasonably anticipated future land use, which is residential. The preferred ground-water alternative was selected over the other alternatives because it is expected to achieve substantial risk reduction through treatment of contaminants in the ground water and provides measures to prevent future exposure to currently contaminated ground water. Hence the combination of Alternatives S3 and G5, hereafter referred to as the Preferred Alternative, reduces the risk within a reasonable time frame and at less cost than the off-site treatment alternative and provides for long-term reliability of the remedy.

Based on the information available at this time, EPA and the State of Tennessee believe the Preferred Alternative would be protective of human health and the environment, would comply with ARARs, would be cost-effective, and would utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Because it would treat the source materials constituting principal threats, the remedy also would meet the statutory preference for the selection of a remedy that involves treatment as a principal element. The Preferred Alternative can change in response to public comment or new information.

COMMUNITY PARTICIPATION

EPA and TDEC provide information regarding the cleanup of the EIO Industrial Site to the public through public meetings, the Administrative Record file for the site, and announcements published in the Nameless, Tennessee Newspaper. EPA and the State encourage the public to gain a more comprehensive understanding of the site and the Superfund activities that have been conducted at the site.

The dates for the public comment period , the date, location, and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

For further information on the EIO Industrial Site, please contact:

John Doe Remedial Project Manager (000) 000-0000	Joan Nameless Community Relations Coordinator (000) 000-0000

U.S. EPA
61 Forsyth Street, S.W.
Atlanta, GA 30303-3104

GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below:

Applicable or relevant and appropriate requirements (ARARs) - the Federal and State environmental laws that a selected remedy will meet. These requirements may vary among sites and alternatives.

Bioremediation - the use of microorganisms to transform or alter, through metabolic or enzymatic action, hazardous organic contaminants into nonhazardous substances.

Carbon adsorption - a process using activated carbon to remove primarily soluble organics from air and water. There are granular and powdered activated carbon based on the size of the carbon particles.

Consent Decree - a legal document, approved by a judge, that formalizes an agreement between EPA and one or more potentially responsible parties (PRPs) outlining the terms by which the response action will take place. A Consent Decree is subject to a public comment period prior to its approval by a judge, and is enforceable as a final judgement by a court.

Contaminant plume - a column of contamination with measurable horizontal and vertical dimensions that is suspended in and moves with ground water.

Ex situ - the removal of a medium (for example, water or soil) from its original place, as through excavation, in order to perform the remedial action

Ground water - underground water that fill pores in soils or openings in rocks to the point of saturation. Ground water is often used as a source of drinking water via municipal or domestic wells.

LDR - Land Disposal Restriction. The land disposal restrictions program requires certain wastes to be treated before they may be disposed of in the land.

Monitoring - ongoing collection of information about the environment that helps gauge the effectiveness of a clean-up action. Monitoring wells drilled at different levels at the EIO Site would be used to detect any leaks from containment structures.

Organic compounds - carbon compounds, such as solvents, oils, and pesticides. Most are not readily dissolved in water. Some organic compounds can cause cancer.

Present Worth Analysis - a method of evaluation of expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared on the basis of a single figure for each alternative. When calculating present worth cost for Superfund sites, total operations & maintenance costs are to be included.

Resource Conservation and Recovery Act (RCRA) - the Federal act that established a regulatory system to track hazardous wastes from the time they are generated to their final disposal. RCRA also provides for safe hazardous waste management practices and imposes standards for transporting, treating, storing, and disposing of hazardous waste.

Revegetate - to replace topsoil, seed, and mulch on prepared soil to prevent wind and water erosion.

Safe Drinking Water Act Maximum Contaminant Level (SDWA MCL) - the maximum permissible level of a contaminant in water that is delivered to any user of a public water system.

Treatability Variance - where a remedial alternative cannot achieve a LDR treatment standard, treatability variance may be granted. A treatability variance establishes alternate treatment standards.

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the Proposed Plan for the EIO Industrial Site is important to EPA. Comments provided by the public are valuable in helping EPA select a final cleanup remedy for the site.

You may use the space below to write your comments, then fold and mail. Comments must be postmarked by March 30, 1999. If you have any questions about the comment period, please contact Joan Nameless at (000) 000-0000 or through EPA's toll-free number at 1-800-000-0000. Those with electronic communications capabilities may submit their comments to EPA via Internet at the following e-mail address: nameless.joan@epa.gov.

Name____

Address______________________________________

City____

State____________________ **Zip**__________________

APPENDIX B:

DOCUMENTING SPECIAL GROUND-WATER REMEDY DECISIONS

This section presents recommendations and suggested language for remedy selection decision documents when ground-water remedies involve the following situations:

- Use of a phased approach to ground-water restoration.
- Remediation of sites where non-aqueous phase liquids (NAPLs) are present (or highly suspected) in the subsurface.
- Deferral of ex-situ treatment components of a pump and treat remedy until Remedial Design.
- Remedies using monitored natural attenuation to achieve remediation objectives.

General background information, examples of how the situations named above should be documented, and references to additional information are detailed below.

B.1 PHASED APPROACH

Where complex ground-water contamination problems are present at a site (*e.g.*, complex hydrogeology or non-aqueous phase liquids), it will generally be necessary to implement a phased approach toward the cleanup of that site. In a phased remedy, site response activities are implemented in a sequence of steps so that the information gained in earlier phases can be used to refine subsequent investigation objectives or actions. Ground-water response actions, in particular those using extraction and treatment, should generally be implemented in more than one phase. Phased response actions can be implemented by either two separate actions where an early or interim ground-water remedy is followed by a later, more comprehensive, long-term remedy (*i.e.* using separate decision documents), or one action that is implemented in more than one phase (in one decision document).

The following information should be included in the *Selected Remedy* section of a ROD (and *Preferred Alternative* section of the Proposed Plan when phased implementation of a remedy is planned):

- Ultimate remedial action objectives for contaminated ground water at the site.
- Clear identification of the purpose and scope of each phase and the interrelationships between the phases.
- Estimated time period for operation and monitoring of each phase.
- Explanation of how performance data from an earlier phase will be used to refine scope or design of later phases.
- Explanation that the last phase of the remedy will consist of refinement of the remedy to increase remedy performance during the operating life of the remedy. Such refinements are relatively minor modifications that would not be considered significant changes (*e.g.*, optimizing pumping rates or placement/abandonment of ground-water extraction wells).

Where appropriate, this section should also state that performance data from an early phase of the remedy may show that attainment of the ultimate remediation objectives is not technically practicable, which would result in re-evaluation of the Selected Remedy and preclude implementation of later remedy phases.

Highlight B-1 illustrates how a phased approach for a single action is described in the *Selected Remedy* section of a ROD.

Highlight B-1: Example Language for Documenting Use of Phased Implementation for the Extraction Component of a Remedy at a DNAPL Site in the Selected Remedy Section of a ROD

The ultimate objectives for the ground-water portion of this remedial action is to restore Aquifer A to its beneficial uses to the maximum extent practicable. The beneficial use of Aquifer A is as a source of drinking water and is currently used off-site for this purpose. Based on information obtained during the remedial investigation and a careful analysis of all remedial alternatives, EPA and the State believe that the Selected Remedy will achieve this objective in a reasonable time frame.

The extraction portion of the ground-water remedy will be implemented in two phases. During phase one, a sufficient number of extraction wells will be installed and operated to achieve the following remedial objectives: 1) minimize further migration of contaminants from suspected subsurface DNAPL areas to the surrounding ground water; and 2) minimize further migration of the leading edge of the contaminant plume. After construction of phase one is complete, the extraction system will be monitored on a regular basis and its performance evaluated. Operation and monitoring of phase one may be necessary for a period of up to two years to provide enough information to complete the phase two design.

Evaluation of the monitoring data collected during phase one may provide further information concerning the likelihood that DNAPLs are present in the aquifer, and if so, the likely extent of the DNAPL zone. EPA will use this information to determine whether an ARAR-waiver is appropriate for the suspected DNAPL zone. If EPA determines that attaining cleanup levels is “technically impracticable from an engineering perspective,” these cleanup levels would be waived over the suspected DNAPL zone (a TI waiver). If EPA determines that a TI waiver is appropriate for this site, the selected remedy will be re-evaluated. In this event EPA would issue a ROD Amendment and phase two of the remedy may be modified from that described below.

During phase two of this remedy, additional extraction wells will be installed with the objective of restoring Aquifer A as a viable source of drinking water to the maximum extent practicable. Reinjection wells and related pumping equipment for flushing a portion of the treated ground water through the aquifer (water flooding) will be installed to enhance the recovery of contaminants. Restoration is defined as attainment of required cleanup levels in the aquifer, over the full extent of the contaminant plume. Cleanup levels for each ground-water contaminant of concern are specified in Table ___.

Current estimates indicate that cleanup levels can be attained in the portion of Aquifer A outside the suspected DNAPL zone within a time frame of approximately 25 years. Monitoring and evaluation of the performance of phase one will be used to determine the actual number and placement of wells for phase two. The system’s performance will be carefully monitored, in accordance with the monitoring plan defined in Section ___ of the ROD, and adjusted and refined as warranted by the performance data collected during operation.

Once phase two of the remedy has been implemented, some refinement to the extraction component of the remedy may still be needed to enhance remedy performance or to maintain performance at reduced cost. These minor adjustments could include one or more of the following:

- Adjusting the rate of extraction from some or all wells.
- Discontinuing pumping at individual wells where cleanup levels have been attained.
- Pulsed pumping of some or all extraction wells to eliminate flow stagnation areas, allow sorbed contaminants to partition into ground water, or otherwise facilitate recovery of contaminants from the aquifer.
- Installing additional ground-water extraction wells to facilitate or accelerate cleanup of the contaminant plume.

For the purpose of estimating the approximate cost of the treatment component of the Selected Remedy, it is estimated that three to five extraction wells will need to be installed as part of phase one and an additional two to six extraction wells and two to four reinjection wells will need to be installed as part of phase two.

NOTE: Ex-situ treatment component of remedy and discharge of treated water are discussed in subsequent paragraphs of the *Selected Remedy* section of the ROD (See Highlight B-2).

B.2 NONAQUEOUS PHASE LIQUIDS (NAPLS)

Nonaqueous phase liquids (NAPLs) are either singular free product organic compounds or mixtures of organic compounds that are resistant to mixing with water. There are two types of NAPLs, Light Nonaqueous Phase Liquids (LNAPLs) and Dense Nonaqueous Phase Liquids (DNAPLs). LNAPLs are less dense than water and tend to float on the water table (*e.g.*, gasoline). DNAPLs have a density greater than water. This property allows them to sink through the water table and penetrate the deeper portions of an aquifer, making them difficult to locate and remediate. Examples of DNAPLs include some chlorinated solvents (*e.g.*, TCE), coal tar wastes, creosote based wood-treating oils, and some pesticides. NAPL zones are the delineated portions of the subsurface (including one or more aquifers) where immiscible liquids (free-phase or residual NAPL) are present.

In general, restoration of an aquifer contaminated with DNAPLs to ARARs or risk-based cleanup levels in a reasonable time frame will not be attainable in the DNAPL zone unless the DNAPLs can be removed. Removing DNAPLs from the subsurface is often not practicable. Due to the inherent difficulty in the treatment of DNAPLs, Technical Impracticability (TI) Waivers are often appropriate for areas of an aquifer associated with DNAPLs (the DNAPL zone). That portion of the contamination plume outside of the DNAPL zone can often be restored to beneficial uses. Different remediation objectives should be developed for the DNAPL zone and for the portion of the aquifer outside of the DNAPL zone.

Highlight B-1 also presents example language for the *Selected Remedy* section of a ROD for a DNAPL site where the remedy is to be implemented in phases. Please refer to Chapter 9 for details on the sections of the Proposed Plan and ROD that will be impacted by use of a TI waiver.

B.3 DEFERRAL TO THE DESIGN PHASE - SELECTION OF EX-SITU TREATMENT METHODS

Although the technologies employed for treating extracted ground water are important components of a remedy, they have little influence on reducing contaminant levels in the aquifer or minimizing plume migration. Presumptive technologies for the ex-situ treatment component of a pump and treat remedy are identified in *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (EPA 540-R-96-023, October 1996). A given treatment train could include a combination of one or more of the presumptive technologies for treatment of dissolved contaminants as well as other technologies for other purposes (*e.g.*, separation of solids or treatment of vapor phase contaminants).

Presumptive technologies for ex-situ treatment of dissolved organic contaminants (*e.g.*, volatiles, semivolatiles) are:

- Air stripping
- Granular activated carbon (GAC)
- Chemical/UV oxidation (for cyanides also)
- Aerobic biological reactors

Presumptive technologies for ex-situ treatment of dissolved metals are:

- Chemical precipitation
- Ion exchange/adsorption
- Electrochemical methods (when metals are the only dissolved contaminants)
- Aeration of background metals

At the ROD stage, the lead agency often lacks important site information needed for optimizing the selection of technologies to treat extracted ground water. In such cases it may be appropriate to defer final selection among ex-situ treatment technologies to the remedial design phase, when the needed information will be available. The technologies that may ultimately be selected and the timing and criteria for the future technology selection should be described in sufficient detail in the Proposed Plan so that the public can evaluate and comment on the proposal. The Proposed Plan provides the foundation for the ROD to defer the final technology selection to the remedial design phase.

The following information should be provided in the *Selected Remedy* section of the ROD (and the *Preferred Alternative* section of the Proposed Plan):

- Statement that one or more of the presumptive treatment technologies described in *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* will be used.

- Statement that the actual technologies and sequence in which they will be employed is being deferred until the remedial design stage, when additional information will be available.

- Description of what the treatment system will be designed to accomplish (*e.g.*, attain State requirements for discharge to surface water).

- Reference the presumptive remedy guidance cited above for a description of presumptive technologies and their advantages and limitations.

- Assumed treatment sequence and statement that this will be used only as a basis for estimating remedy costs (in this case, for the aqueous and vapor phase contaminants in ground water).

Highlight B-2 provides example Selected Remedy language for a case where selection of a specific presumptive technology for treatment of extracted ground water was deferred until the Remedial Design phase.

B.4 DOCUMENTING REMEDIES USING MONITORED NATURAL ATTENUATION

Monitored natural attenuation (MNA) may be utilized as a remedy or as a portion of a remedy, to address site contamination. Guidance on the use of monitored natural attenuation for the remediation of contaminated soil and ground water can be found in *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (EPA 540-F-99-009, April 1999).

Monitored natural attenuation, as defined in the OSWER Directive, "refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The 'natural attenuation processes' that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or ground water."[1]

EPA does not view MNA to be a "no action" remedy[2], but rather considers it to be a means of addressing contamination under a limited set of site circumstances where its use meets the applicable statutory and regulatory requirements. Also, MNA should be evaluated and compared to other viable remediation methods (including innovative technologies) during the study phases leading to the selection of a remedy and should not be considered a "presumptive" or "default" remediation alternative. The decision to implement MNA should include a comprehensive site characterization, risk assessment where appropriate, and measures to treat or otherwise control sources. In addition, the progress of natural attenuation towards a site's remediation objectives should be carefully monitored and compared with expectations to ensure that it will meet site remediation objectives within a time frame that is reasonable compared to time frames associated with other methods. Where MNA's ability to meet these expectations is uncertain and based predominantly on predictive analyses, decision-makers should incorporate contingency measures into the remedy.

If monitored natural attenuation comprises all or part of the remedy, the following points should be included in the *Summary of Alternatives* section of a Proposed Plan or the *Description of Alternatives* section of a ROD:

- A brief explanation of why natural processes are expected to achieve remedial objectives in a time frame that is reasonable in comparison to other alternatives.

[1] Natural attenuation processes can also convert some contaminants to more toxic forms.

[2] A remedial alternative using natural attenuation as the cleanup method is not the same as the "no action alternative." When cleanup is required, natural attenuation may be able to attain cleanup levels in a timeframe that is "reasonable" when compared to other comparable alternatives. In general, the "no action" alternative is appropriate only when cleanup is not required.

Highlight B-2: Example Language for Selected Remedy Section of a ROD Deferring Selection of Treatment Component

The ex-situ treatment component of the ground-water remedy will utilize presumptive technologies identified in *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites* (EPA 540-R-96-023, October 1996), included as Appendix __ of the ROD. Since contaminants of concern include volatile and semivolatile organic compounds, one or more of the presumptive technologies - air stripping, granular activated carbon (GAC), chemical/UV oxidation and aerobic biological reactors - will be used for treating aqueous contaminants in the extracted ground water. Other technologies will also be needed in the treatment system for removal of suspended mineral solids and treatment of vapor phase contaminants. The actual technologies and sequence of technologies used for the treatment system will be determined during the remedial design. Final selection of these technologies will be based on additional site information to be collected during the remedial design. (See Section 3.4 and Appendix C3 of EPA 540-R-96-023 for a discussion of site information needed for selection and design of the ex-situ treatment system.) Based on this additional information and sound engineering practice the treatment system shall be designed to accomplish the following:

- Attain the chemical-specific treatment levels specified in the State NPDES permit (see Table__) and other performance criteria specified in Table __ of the ROD.
- Treat, or be easily modified to treat, the expected flow increase from phase one to phase two of the extraction system.

Other design factors shall include the following:

- Maximizing long-term effectiveness.
- Maximizing long-term reliability (*i.e.*, minimize the likelihood of process upsets).
- Minimizing long-term operating costs.

Additional information concerning presumptive technologies for the ex-situ treatment component of the remedy is provided in EPA 540-R-96-023. In this directive, descriptions of each of the presumptive technologies are presented in Appendices D1 through D8, and advantages and limitations of each of these technologies are listed in Appendix C4.

For the purpose of estimating the approximate cost of the treatment component of the Selected Remedy, the following treatment sequence is assumed for contaminants dissolved in ground water: flow equalization tanks, a gravity oil-water separator, an air stripper, followed by GAC units. GAC will also be used to treat vapor phase contaminants from the air stripper. The GAC units will be thermally reactivated at an off-site facility. Separated DNAPL compounds will be recycled if possible, but since the actual composition of the recovered liquids is unknown, costs for incineration at an off-site facility were used for the cost estimate.

- If a relatively long time frame is required for natural processes to attain remediation goals, explain why this remediation time period is appropriate for conditions at the site (*e.g.*, no anticipated need for site ground water during this period).

- A description of the performance monitoring that will be part of the remedy and will be used to determine if natural attenuation is proceeding as anticipated.

- If applicable, a description of the contingency measures that will be implemented should the monitoring show that natural attenuation is unable to achieve the cleanup goals. Conditions that would trigger the contingency should also be specified (e.g., continued plume migration or contaminant levels are well above levels predicted for a specified time)

- Describe the institutional controls that will be implemented to prevent use of contaminated ground water until cleanup levels are achieved.

Example language for documenting use of monitored natural attenuation in the *Selected Remedy* section of the ROD is provided in Highlight B-3.

B.5 ADDITIONAL INFORMATION FOR SPECIAL GROUND-WATER REMEDIES

Additional guidance can be found in Sections 9.4 and 9.5 of this document and in the following:

- *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites, Final Guidance* (EPA 540-R-96-023, October 1996) (Note: Highlights B-1 and B-2 in this Appendix were adapted from Appendix B of this guidance document.)

- *Considerations in Ground-Water Remediation of Superfund Sites and RCRA Facilities* (OSWER 9283.1-06, May 1992).

- *Guidance for Evaluating the Technical Impracticability of Ground-Water Restoration* (EPA 540-R-93-080, October 1993).

- *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (EPA 540-F-99-009, April 1999)

Highlight B-3: Example Language for Documenting Use of Monitored Natural Attenuation in the Selected Remedy Section of the ROD

The ultimate objective for the ground-water portion of this remedial action is to restore contaminated ground water in Aquifer A to its beneficial uses. This aquifer could be used as a future source of drinking water, but is not being used currently for this purpose either on-site or off-site. Based on information obtained during the remedial investigation and a careful analysis of all remedial alternatives, EPA and the State believe that the Selected Remedy will achieve this objective in a reasonable time frame.

Monitored natural attenuation (Alternative 4) will be used to restore Aquifer A to its future beneficial use as a source of drinking water. Cleanup levels for each ground-water chemical of concern (COC) are specified in Table ___. Current estimates indicate that cleanup levels will be attained throughout the contaminated portion of Aquifer A within approximately 25 years. This compares to an estimated time frame of ten years for those alternatives that involve pumping and treating of ground water (Alternatives 2 and 3). (See Appendix __ of the RI/FS for further information concerning the predictive models used for this estimate.) Although the estimated time for natural processes to attain remediation objectives is longer than that required for alternatives using pump and treat, twenty-five years is considered a reasonable remedial time for this site because there is no anticipated need for the contaminated ground water within this period (see *Current and Potential Future Site Use* section of the ROD).

In addition to the modeling estimates, concentration levels for all COCs have decreased since source control measures were completed (OU1). This trend of declining contaminant levels has been confirmed in four successive rounds of sampling over a period of three years, indicating that source control measures have been effective and are reducing the uncertainty of the modeling predictions.

Since two separate lines of evidence (trends of declining COCs and predictive modeling) were used to indicate that monitored natural attenuation would be successful in attaining remediation objectives for site ground water, EPA and the State have determined that contingency measures are not needed as part of the remedy selected in this ROD.

Actual performance of the natural attenuation remedy will be carefully monitored in accordance with the monitoring plan detailed in Section__ of the ROD. If monitoring data indicate that contaminant levels do not continue to decline, as estimated in the modeling predictions, EPA and the State will reconsider the remedy decision. One or more of the following observations could lead to re-consideration of the remedy, if confirmed by four or more rounds of sampling:

- Increase in levels of parent contaminants, indicating that other sources may be present.
- Concentration levels of parent contaminants and/or daughter products differ significantly from modeling predictions.
- Contaminant plume for parent contaminants and daughter products increases significantly in areal or vertical extent and/or volume from that predicted by modeling estimates.

Institutional controls will be implemented to prevent the use of contaminated ground water until the cleanup levels specified in Table ___ have been attained throughout Aquifer A. These institutional controls will consist of a county ordinance prohibiting drilling of wells within the vicinity of the plume. An ordinance is expected to be effective in preventing ground-water use, because the county requires that a permit be obtained prior to drilling a public or private water supply well and no permit can be issued in areas known to be contaminated.